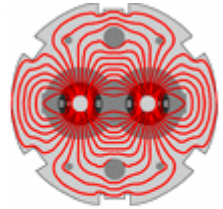


LARP

LHC@FNAL

Remote Operations for CMS

Erik Gottschalk

Introduction

We are designing a joint CMS and LHC remote operations center on the first floor of Wilson Hall.

We are looking for input:

- **Functional aspects (operations, communications, outreach)**
- **Physical aspects (computing, networking, conferencing, layout)**

Send questions or suggestions to:

- **remop@fnal.gov**

Additional information is available:

http://cd-amr.fnal.gov/remop/remop.html

Overview

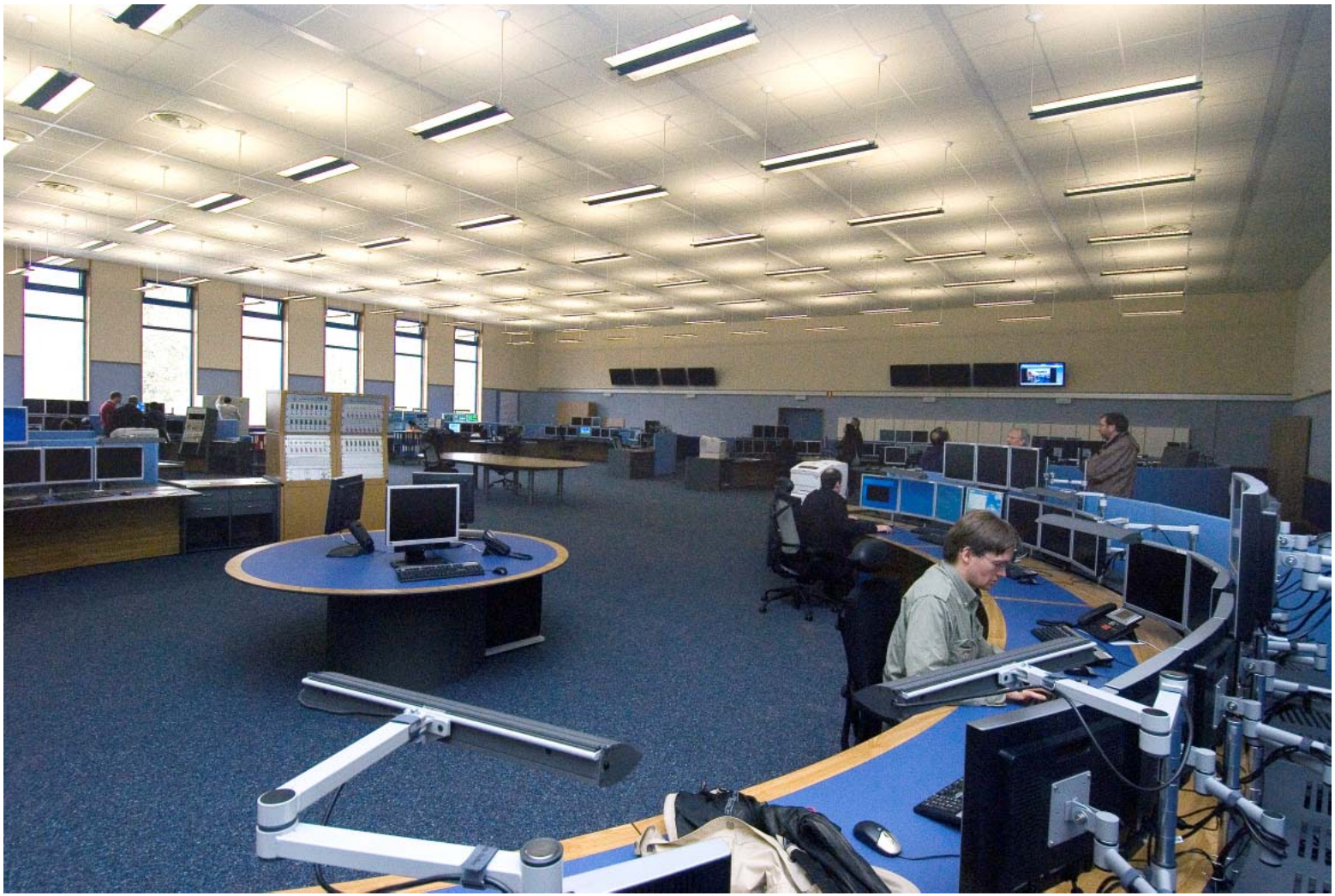
- Control rooms at CERN
- Remote operations centers
- Plans and goals for LHC@FNAL
- Computing requirements
- WBS & computing security
- SciDAC-2 Proposal
- Summary

Control Rooms at CERN

- Temporary CMS control room (“green barracks”)
- CMS control room at Point 5
  - Under construction
  - Small control room, low ceiling
  - ~13 km from CERN (Meyrin)
- New accelerator control room – **C**ERN **C**ontrol **C**entre

  The CCC combines all of the control rooms for the accelerators, cryogenic systems and technical infrastructure into one room. The CCC began operations on February 1st, 2006.

CERN Control Centre



Remote Operations Centers

Paris Sphicas (CPT Week, Jan. 30 - Feb. 3, 2006):

Asymptotically, at sufficiently long times after startup, we will run CMS remotely

- This is not a question of whether this will happen – it's a question of when.

- CCAR (planned for Meyrin)
  - Remote operations (and control) center for CMS
  - Described as the "heartbeat" of CMS at CERN

- ROC and LHC@FNAL
  - Remote operations center for CMS commissioning and operations, and LHC beam commissioning and operations

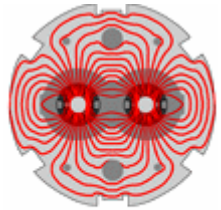
Why build a Remote Operations Centre?

1) Dedicated facility to support CMS and LHC commissioning and operations.
   - Remote shifts

2) Facilitate communication with CMS and LHC control rooms.
   - Call center for US-CMS collaborators to access information about CMS and the LHC accelerator.
   - Introduce collaboration tools to improve communication

3) Take advantage of a unique opportunity to have detector and accelerator experts working together to solve problems.

Goals for LHC@FNAL



LARP

- Participate in shifts from the U.S.
- Participate in data monitoring and analysis
- Monitor US-CMS offline computing operations
- Develop and test new monitoring capabilities
- Provide access to data, data summaries, and analysis results
- Provide training in preparation for shift activities at CERN
- Assist in establishing communications between accelerator and detector experts in North America and CERN

LHC@FNAL Task Force

- Erik Gottschalk – Chair (FNAL-PPD)
- Kurt Biery (FNAL-CD)
- Suzanne Gysin* (FNAL-CD)
- Elvin Harms* (FNAL-AD)
- Shuichi Kunori (U. of Maryland)
- Mike Lamm* (FNAL-TD)
- Mike Lamont* (CERN-AB)
- Kaori Maeshima (FNAL-PPD)
- Patty McBride (FNAL-CD)
- Elliott McCrory* (FNAL-AD)
- Andris Skuja (U. of Maryland)
- Jean Slaughter* (FNAL-AD)
- Al Thomas (FNAL-CD)

* Accelerator Subgroup

LHC@FNAL also has an advisory committee with members from Universities, FNAL, CERN-PH, CERN-AB, and CERN-TS.

Planning for LHC@FNAL

- The LHC@FNAL task force developed a plan for CMS remote operations based on discussions with members of CDF, D0, CMS HCAL and trackers groups.
- We worked with CMS and US-CMS management at all steps in the process.
- A requirements document for LHC@FNAL was prepared and reviewed last summer.
- We visited 9 sites (e.g. Hubble, NIF, ESOC) to find out how other projects do remote operations.
- The goal is to have LHC@FNAL ready before the start of beam (end of 2006).

Computing Requirements

1 – 10. CMS Monitoring Data Access	280	
LHC@FNAL shall have access to network-accessible monitoring data that is available in the main CMS Control Room. This shall include, but not be limited to: • Data quality monitoring (DQM) information • Databases for CMS subsystems • Monitoring information provided by the CMS control system • LHC beam conditions and data logged by the LHC control system		

(Page 7)

3 – 1. LHC@FNAL Safeguards		
LHC@FNAL shall have safeguards such that actions do not jeopardize or interfere with the quality of data recorded by CMS, and do not jeopardize or interfere with LHC operations.		

3 – 2. LHC@FNAL Hardware and Software Consistency		
To minimize the impact on CERN resources, LHC@FNAL shall maximize consistency in hardware and software with CERN and obtain software licenses as needed.		

(Page 14)

3 – 3. LHC@FNAL Consoles	120, 138, 213	
LHC@FNAL shall have the same or equivalent consoles installed as the CCC.		

Computing Requirements

3 – 4. LHC@FNAL Communications	120, 126, 128, 138, 178, 213, 280	
Several types of reliable communications shall exist between LHC@FNAL and CMS control rooms, LHC Field Control Rooms, CERN Control Centre, and CMS and LHC collaborators worldwide. The types of communications shall include, but not be limited to: • Telephone (wired and wireless) • On-demand video conferencing • On-demand screen sharing • Simple, prompt electronic messaging with audio alerts (for example, "instant messaging" • E-mail • Electronic logbook		

(Page 14)

4 – 4. Reliable Networking		
Reliable networking shall be available to LHC@FNAL users, equivalent to that normally available to ESNET users. Provision shall be made for redundancy in equipment and cabling in the local LHC@FNAL space such that reduced operations can continue in case of failure.		

(Page 17)

Computing Requirements

4 – 10. Computing and Networking Security		
LHC@FNAL shall have secure computing and networking consistent with the requirements of Fermilab and of CERN.		

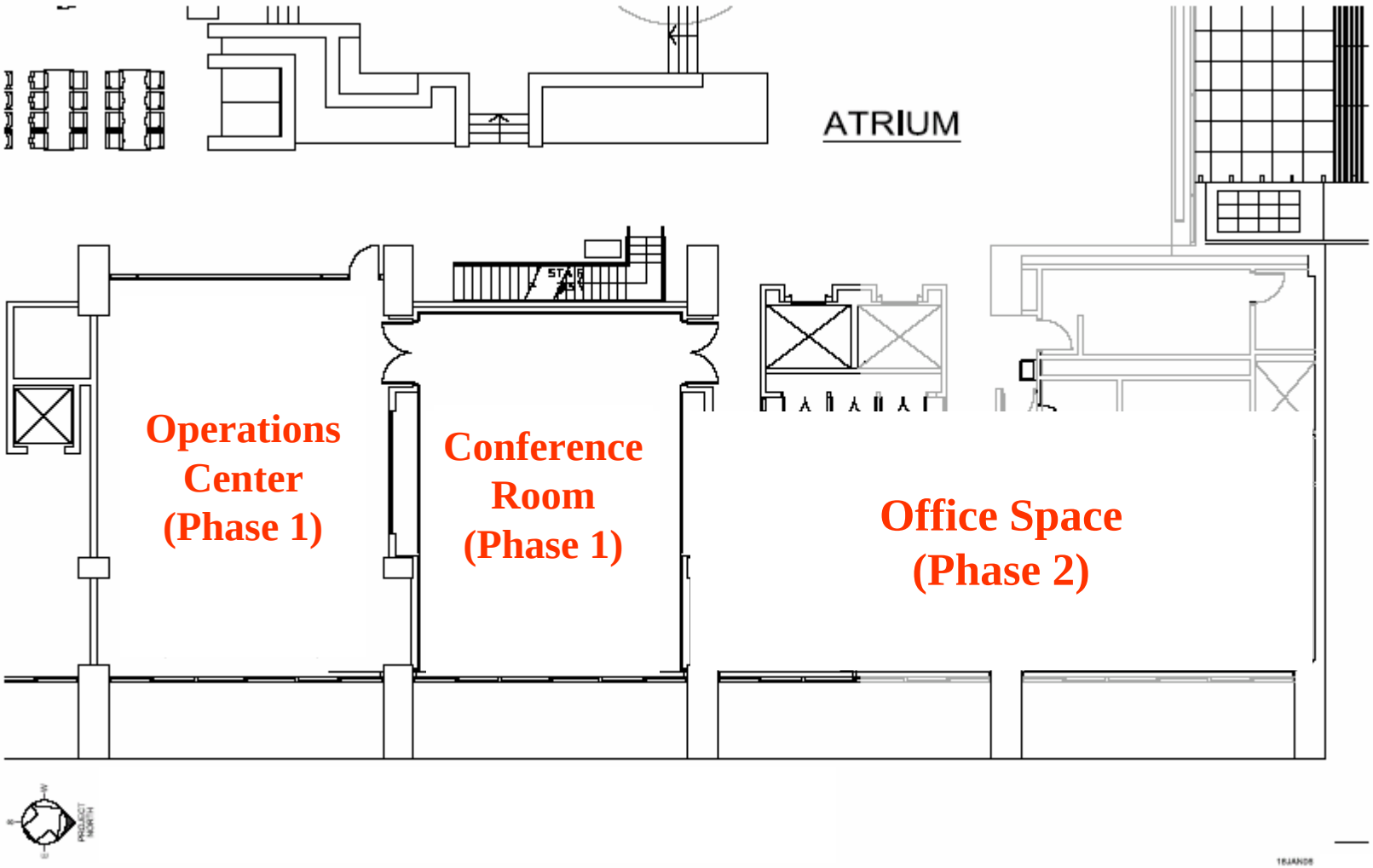
(Page 19)

4 – 11. LHC@FNAL Space Security		
LHC@FNAL space shall be designed such that it can be secured and have access limited to authorized personnel.		

The LHC@FNAL Requirements Document is available at:

http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=165

LHC@FNAL Location & Layout



Possible CMS Activities

Operations Center:

- Online shifts (data quality monitoring, trigger monitoring)
- Offline shifts (data processing, data distribution, GRID)
- Miscellaneous (shift training, DB maintenance)
- Call center for US-CMS

Conference Room (integrated with Ops. Center):

- Daily/weekly meetings

Office Space:

- Two small meeting rooms (3 – 5 people each)
- Expert space
- Rest area for shifters

LHC@FNAL WBS

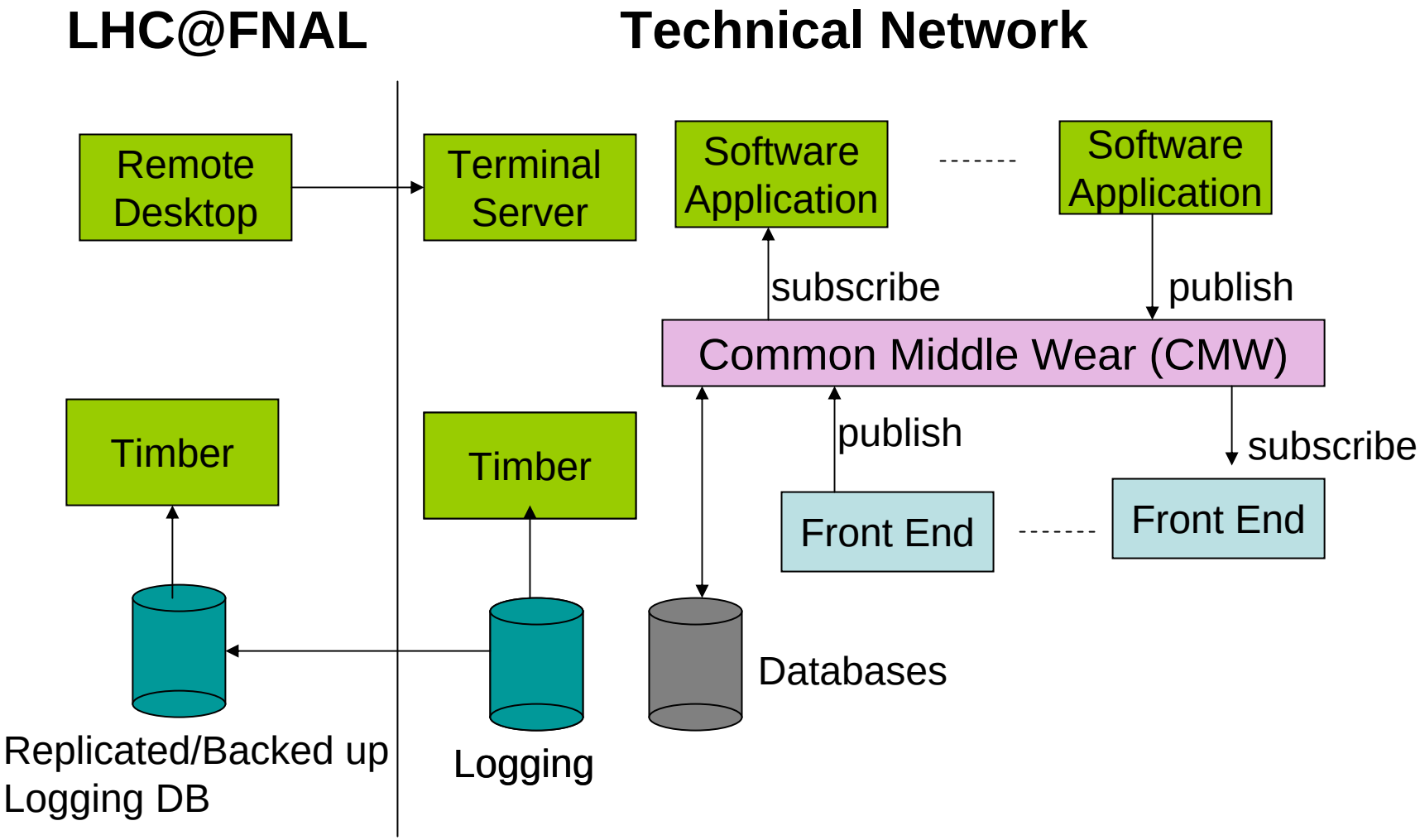
- "Phased" WBS for LHC@FNAL
  - Phase 1 – What is needed in FY06 for Ops. Center & Conf. Room
  - Phase 2 – What is needed after FY06
  - Category 3 – Items that should be paid for by someone else

The phased WBS approach gives us time to address CERN's policy for computing security and to understand specific needs for LHC@FNAL.

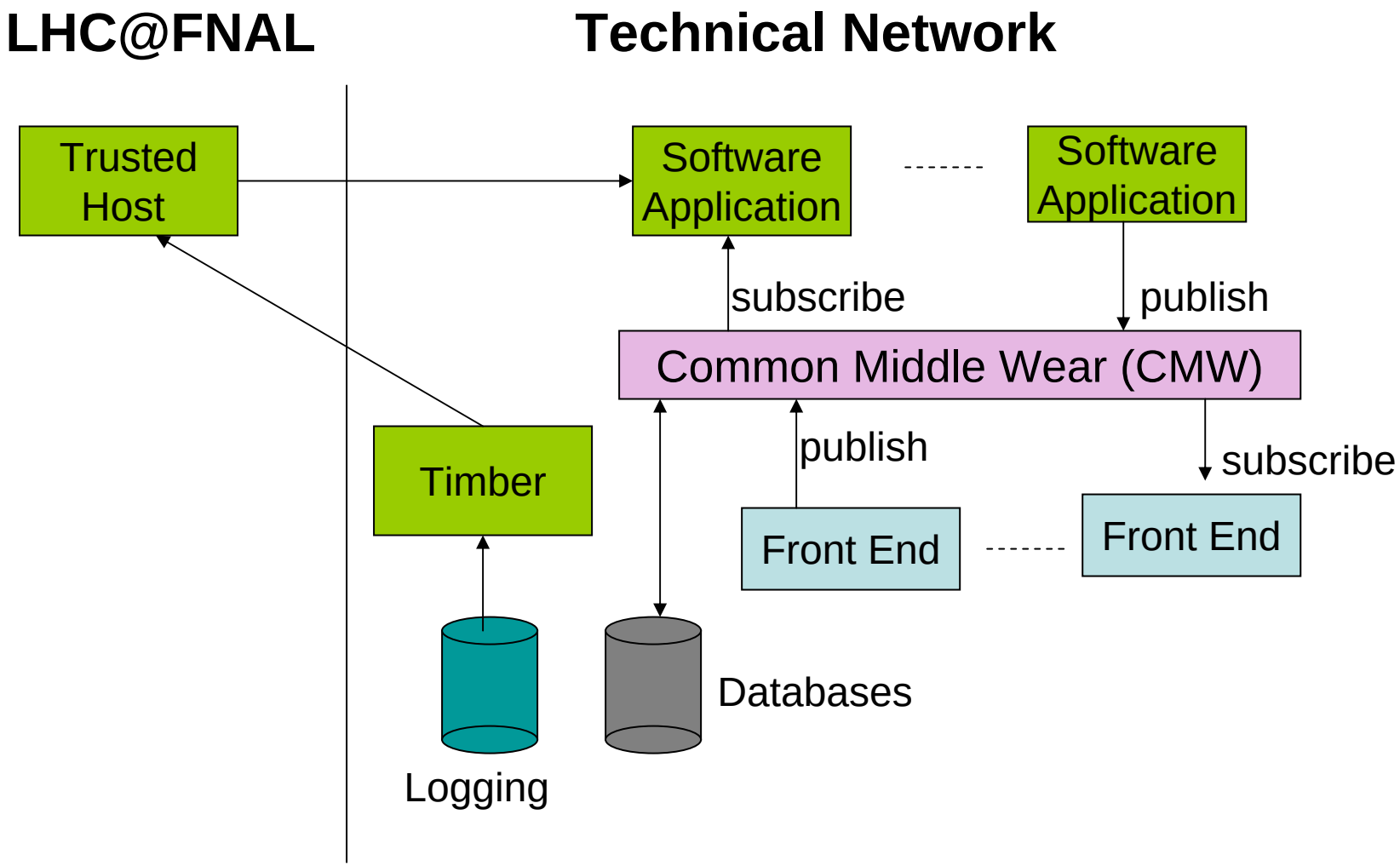
- Base cost (Labor & M&S)
  - Phase 1: $213 K
  - Phase 2: $791 K
  - Category 3: $927 K

The budget for LHC@FNAL assumes a model for remote access that is based on CERN's policy for Computing and Network Infrastructure for Controls (CNIC).

Baseline for LHC Remote Access



Preferred Model for Remote Access



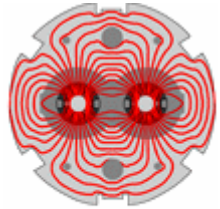
CMS Timetable

- ROC (WH11) renovation started – June 2005
- LHC@FNAL Requirements Review – July 2005
- Preliminary requirements document – July 2005
- ROC renovation completed – September 2005
- Developed LHC@FNAL plan – Fall 2005
- WBS presented to FNAL Directorate – Feb. 2006
- FESS engineering start – March 2006

➢Looking for feedback now!

- LHC@FNAL construction completed – End of 2006
- Move ROC operations to LHC@FNAL – Spring 2007

Computing Division Activities



LARP

We are working with the Computing Division in the following areas:

- Video conferencing for CERN CCC and 1-East
- Networking for LHC@FNAL
- LHC software applications (working with LARP)
- Consulting on CMS remote monitoring
- Remote access and security

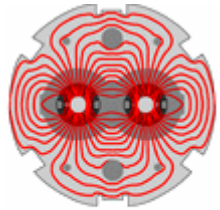
SciDAC-2 Proposal

On March 6, 2006 we submitted a SciDAC-2 Proposal to the DOE.

- The goal of this proposal is to "significantly enhance scientific collaboration" by developing "new tools and technologies."
- For the proposal we are collaborating with Fusion Energy Sciences by working with researchers who are working on ITER (International Thermonuclear Experimental Reactor).
- The FNAL part of the proposal asks for funding to support two FTEs for five years:
  - Develop role-based access (LHC)
  - Develop a data-distribution system for online monitoring data (CMS)

Collaborating institutions: General Atomics, ANL, Caltech, Columbia Univ., FNAL, LBNL, MIT, PPPL, Princeton Univ.

Summary



LARP

We are developing plans for a joint CMS and LHC remote operations center, and are looking for input.

If you have any questions or suggestions contact:

- remop@fnal.gov (LHC@FNAL task force mailing list)
- erik@fnal.gov
- mcbride@fnal.gov
- harms@fnal.gov

Additional Slides

Assumptions

For CMS

- CMS will have a shift schedule, a run plan, and a protocol that defines responsibilities and roles of shift personnel. We assume that a shift leader is responsible for CMS shift activities.
- LHC@FNAL will have shift operators who will be able to assist US-CMS collaborators with CMS activities during commissioning and operations.
- LHC@FNAL will participate in CMS shifts. Neither the duration nor the frequency of the LHC@FNAL shifts has been determined.
- The CMS Collaboration will have a protocol for access to the CMS control system (PVSS), and a policy for how access to the control system will vary depending on the physical location of an individual user.
- The CMS Collaboration will have a policy that defines how DAQ resources are allocated. This includes allocation of DAQ resources to various detector groups for calibration and testing.
- The CMS Collaboration will have a protocol that defines how on-demand video conferencing will be used in CMS control rooms and LHC@FNAL.
- The CMS Collaboration will provide web access to electronic logbook and monitoring information to collaborators worldwide
- The CMS Collaboration will maintain a *call tree* that lists on-call experts worldwide for each CMS subsystem during commissioning and operations

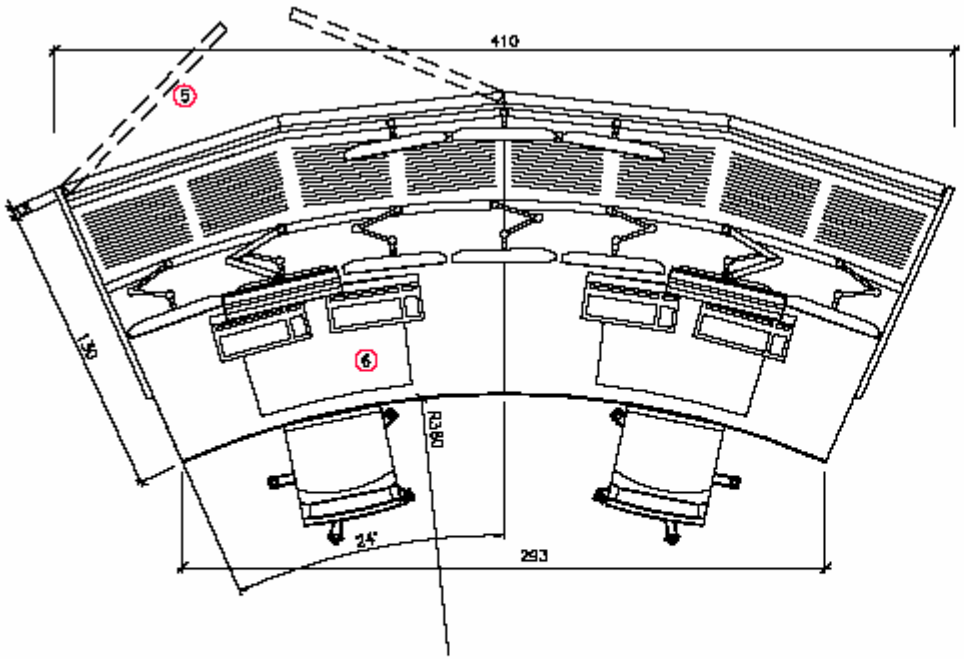
For both CMS & LHC

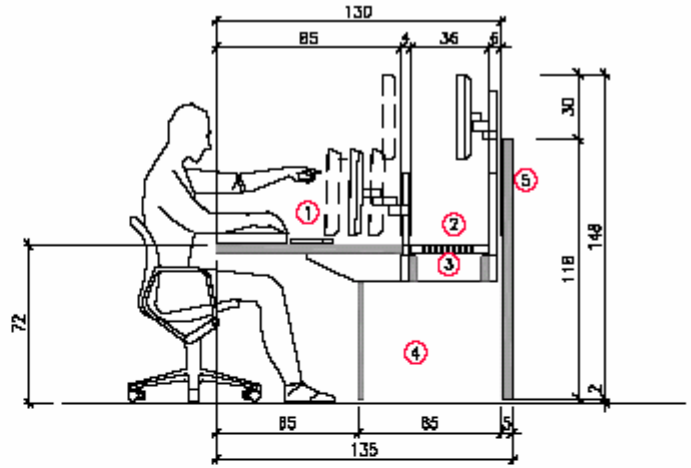
- LHC@FNAL will comply with all CERN and Fermilab safety and security standards.

Site Visits

- **Technology Research, Education, and Commercialization Center (TRECC) – West Chicago, Illinois** (Aug. 25, 2005)
- **Gemini Project remote control room – Hilo, Hawaii** (Sept. 20, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=425
- **Jefferson Lab control room – Newport News, Virginia** (Sept. 27, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=505
- **Hubble Space Telescope & STScI – Baltimore, Maryland** (Oct. 25, 2005)
- **National Ignition Facility – Livermore, California** (Oct. 27, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=532
- **General Atomics – San Diego, California** (Oct. 28, 2005)
- **Spallation Neutron Source – Oak Ridge, Tennessee** (Nov. 15, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=570
- **Advanced Photon Source – Argonne, Illinois** (Nov. 17, 2005)
- **European Space Operations Centre – Darmstadt, Germany** (Dec. 7, 2005)
  - http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=622

Consoles





① Work top
② Monitor top
③ Cable channel
④ Installation room
⑤ Acoustic screen doors
⑥ Insert
⑦ Light–top